SECTION 14
RAPID HABITAT AND VISUAL STREAM ASSESSMENTS

by
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After all other samples and field data have been collected, the field team conducts an visual-based habitat assessment of the stream reach, makes a general visual assessment of the stream and adjacent area, and performs a final check of the data forms and samples before leaving the stream site (see Section 15). The habitat assessment procedures used are those included in EPA's Rapid Bioassessment Protocols (RBP), originally published by Plafkin et al. (1989), and revised by Barbour et al. (1999). The procedures used for EMAP-WP are modified from those published previously for EMAP-SW (Lazorchak et al., 1998), and the original RBP procedures (Plafkin et al., 1989) to include additional assessment parameters for high gradient streams and a more appropriate parameter set for low gradient streams. These modifications are based on refinements d from various applications across the country. The approach focuses on integrating information from specific parameters on the structure of the physical habitat.

The visual stream assessment is used to record field team observations of catchment and stream characteristics that are useful for data validation, future data interpretation, ecological value assessment, development of associations, and verification of stressor data. The observations and impressions of field teams are extremely valuable. Thus, it is important that these observations about stream characteristics be recorded for future data interpretation and validation.

Beginning in 2001, the rapid habitat assessment is an optional activity. The general description of weather conditions at a site are now included on the field form used for the visual assessment. Evidence of fire has been added as a disturbance type for the visual assessment.

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14.1 RAPID HABITAT ASSESSMENT

NOTE: Beginning in 2001, the rapid habitat assessment is an optional procedure.

The rapid habitat assessment approach based on visual observation is separated into two basic approaches—one designed for high-gradient streams and one designed for low-gradient streams. Based on the perception gained from collecting samples and measurements from throughout the sampling reach, classify the stream as either "Riffle/run prevalent" or "Pool/glide prevalent" based on your visual impression of the dominant habitat type. Choose the prevalent habitat type based on which habitat type occupies the majority of the length of the sampling reach. Landscapes of moderate to high-gradient typically contain "riffle/run prevalent" streams. Under natural conditions, riffle/run prevalent streams contain primarily coarse substrates (i.e., coarse gravel or larger; refer to Section 7) or numerous areas dominated by coarse substrates along a stream reach (Barbour et al, 1998). Landscapes of low to moderate gradient are characterized by glide/pool prevalent streams. These streambeds are dominated by finer substrates (fine gravel or smaller)or occasional areas of coarser sediments along a stream reach (Barbour et al., 1999). The entire sampling reach is evaluated for each parameter.

A different field data form is completed depending upon the prevalent habitat type. For each prevalent stream type, ten "parameters" of habitat are considered and evaluated. These parameters are described in Table 14-1. Most of the parameters are evaluated similarly for both types of prevalent habitats. In three cases, a parameter is evaluated differently, or a different (but ecologically equivalent) parameter is evaluated in riffle/run prevalent versus pool/glide prevalent streams. Substrate embeddedness is evaluated in riffle/run prevalent streams, while pool substrate composition is evaluated in pool/glide prevalent streams. The presence of four potential types of microhabitat types based on combinations of depth and current velocity is evaluated in riffle/run prevalent streams, while the presence of four potential types of pool microhabitat based on depth and area are evaluated in pool/glide prevalent streams. The frequency of riffles is evaluated in riffle/run prevalent streams, while channel sinuosity is evaluated in pool/glide prevalent streams. For three parameters, each bank is evaluated separately and the cumulative score (right and left) is used for the reach.

The procedure for conducting the rapid habitat assessment is presented in Table 14-2. For each of the 10 parameters, rate the overall quality of the sampling reach on a scale of 0 to 20. For riffle/run prevalent streams, record your scores for each parameter on the

TABLE 14-1. DESCRIPTIONS OF PARAMETERS USED IN THE RAPID HABITAT ASSESSMENT OF STREAMS[a]

Habitat Parameter (Prevalent Habitat Type R=Riffle/run P=Pool/glide)	Description and Rationale
Parameters Evaluated within Sampling Reach	
1. Epifaunal Substrate/ Available Cover (R, P)	Includes the relative quantity and variety of natural structures in the stream, such as cobble (riffles), large rocks, fallen trees, logs and branches, and undercut banks, available as refugia, feeding, or sites for spawning and nursery functions of aquatic macrofauna. A wide variety and/or abundance of submerged structures in the stream provides macroinvertebrates and fish with a large number of niches, thus increasing habitat diversity. As variety and abundance of cover decreases, habitat structure becomes monotonous, diversity decreases, and the potential for recovery following disturbance decreases. Riffles and runs are critical for maintaining a variety and abundance of insects in most high-gradient streams and serving as spawning and feeding refugia for certain fish. The extent and quality of the riffle is an important factor in the support of a healthy biological condition in high-gradient streams. Riffles and runs offer a diversity of habitat through variety of particle size, and, in many small high-gradient streams, will provide the most stable habitat. Snags and submerged logs are among the most productive habitat structure for macroinvertebrate colonization and fish refugia in low-gradient streams. However, "new fall" will not yet be suitable for colonization.
2A. Embeddedness (R)	Refers to the extent to which rocks (gravel, cobble, and boulders) and snags are covered or sunken into the silt, sand, or mud of the stream bottom. Generally, as rocks become embedded, the surface area available to macroinvertebrates and fish (shelter, spawning, and egg incubation) is decreased. Embeddedness is a result of large-scale sediment movement and deposition, and is a parameter evaluated in the riffles and runs of high-gradient streams. The rating of this parameter may be variable depending on where the observations are taken. To avoid confusion with sediment deposition (another habitat parameter), observations of embeddedness should be taken in the upstream and central portions of riffles and cobble substrate areas.
2B. Pool Substrate Characterization (P)	Evaluates the type and condition of bottom substrates found in pools. Firmer sediment types (e.g., gravel, sand) and rooted aquatic plants support a wider variety of organisms than a pool substrate dominated by mud or bedrock and no plants. In addition, a stream that has a uniform substrate in its pools will support far fewer types of organisms than a stream that has a variety of substrate types.
3A. Velocity and Depth Regimes (R)	Patterns of velocity and depth are included for high-gradient streams under this parameter as an important feature of habitat diversity. The best streams in most high-gradient regions will have all 4 patterns present: (1) slow-deep, (2) slow-shallow, (3) fast-deep, and (4) fast-shallow. The general guidelines are 0.5 m depth to separate shallow from deep, and 0.3 m/sec to separate fast from slow. The occurrence of these 4 patterns relates to the stream's ability to provide and maintain a stable aquatic environment.
3B. Pool Variability (P)	Rates the overall mixture of pool types found in streams, according to size and depth. The 4 basic types of pools are large-shallow, large-deep, small-shallow, and small-deep. A stream with many pool types will support a wide variety of aquatic species. Rivers with low sinuosity (few bends) and monotonous pool characteristics do not have sufficient quantities and types of habitat to support a diverse aquatic community. General guidelines are any pool dimension (i.e., length, width, oblique) greater than half the cross-section of the stream for separating large from small and 1 m depth separating shallow and deep.

[a] Modified from Barbour et al. (1999)

(continued)

TABLE 14-1[a] (Continued)

Habitat Parameter (Prevalent Habitat Type R=Riffle/ run P=Pool/ glide)	Description and Rationale
4. Sediment Deposition (R, P)	Measures the amount of sediment that has accumulated in pools and the changes that have occurred to the stream bottom as a result of deposition. Deposition occurs from large-scale movement of sediment. Sediment deposition may cause the formation of islands, point bars (areas of increased deposition usually at the beginning of a meander that increase in size as the channel is diverted toward the outer bank) or shoals, or result in the filling of runs and pools. Usually deposition is evident in areas that are obstructed by natural or manmade debris and areas where the stream flow decreases, such as bends. High levels of sediment deposition are symptoms of an unstable and continually changing environment that becomes unsuitable for many organisms.
5. Channel Flow Status (R, P)	The degree to which the channel is filled with water. The flow status will change as the channel enlarges (e.g., aggrading stream beds with actively widening channels) or as flow decreases as a result of dams and other obstructions, diversions for irrigation, or drought. When water does not cover much of the streambed, the amount of suitable substrate for aquatic organisms is limited. In high-gradient streams, riffles and cobble substrate are exposed; in low-gradient streams, the decrease in water level exposes logs and snags, thereby reducing the areas of good habitat. Channel flow is especially useful for interpreting biological condition under abnormal or lowered flow conditions. This parameter becomes important when more than one biological index period is used for surveys or the timing of sampling is inconsistent among sites or annual periodicity.
Parameters Evaluated Broader than the Sampling Reach	
6. Channel Alteration (R, P)	Is a measure of large-scale changes in the shape of the stream channel. Many streams in urban and agricultural areas have been straightened, deepened, or diverted into concrete channels, often for flood control or irrigation purposes. Such streams have far fewer natural habitats for fish, macroinvertebrates, and plants than do naturally meandering streams. Channel alteration is present when artificial embankments, riprap, and other forms of artificial bank stabilization or structures are present; when the stream is very straight for significant distances; when dams and bridges are present; and when other such changes have occurred. Scouring is often associated with channel alteration.
7A. Frequency of Riffles (or Bends) (R)	Is a way to measure the sequence of riffles and thus the heterogeneity occurring in a stream. Riffles are a source of high-quality habitat and diverse fauna, therefore, an increased frequency of occurrence greatly enhances the diversity of the stream community. For high gradient streams where distinct riffles are uncommon, a run/bend ratio can be used as a measure of meandering or sinuosity (see 7b). A high degree of sinuosity provides for diverse habitat and fauna, and the stream is better able to handle surges when the stream fluctuates as a result of storms. The absorption of this energy by bends protects the stream from excessive erosion and flooding and provides refugia for benthic invertebrates and fish during storm events. To gain an appreciation of this parameter in some streams, a longer segment or reach than that designated for sampling should be incorporated into the evaluation. In some situations, this parameter may be rated from viewing accurate topographical maps. The "sequencing" pattern of the stream morphology is important in rating this parameter. In headwaters, riffles are usually continuous and the presence of cascades or boulders provides a form of sinuosity and enhances the structure of the stream. A stable channel is one that does not exhibit progressive changes in slope, shape, or dimensions, although short-term variations may occur during floods (Gordon et al. 1992).

[a] Modified from Barbour et al. (1999)

(continued)

TABLE 14-1[a] (Continued)

Habitat Parameter (Prevalent Habitat Type R=Riffle/run P=Pool/glide)	Description and Rationale
7B. Channel Sinuosity (P)	Evaluates the meandering or sinuosity of the stream. A high degree of sinuosity provides for diverse habitat and fauna, and the stream is better able to handle surges when the stream fluctuates as a result of storms. The absorption of this energy by bends protects the stream from excessive erosion and flooding and provides refugia for benthic invertebrates and fish during storm events. To gain an appreciation of this parameter in low gradient streams, a longer segment or reach than that designated for sampling may be incorporated into the evaluation. In some situations, this parameter may be rated from viewing accurate topographical maps. The “sequencing” pattern of the stream morphology is important in rating this parameter. In "oxbow" streams of coastal areas and deltas, meanders are highly exaggerated and transient. Natural conditions in these streams are shifting channels and bends, and alteration is usually in the form of flow regulation and diversion. A stable channel is one that does not exhibit progressive changes in slope, shape, or dimensions, although short-term variations may occur during floods (Gordon et al. 1992).
8. Bank Stability (Condition of Banks) (R, P)	Measures whether the stream banks are eroded (or have the potential for erosion). Steep banks are more likely to collapse and suffer from erosion than are gently sloping banks, and are therefore considered to be unstable. Signs of erosion include crumbling, unvegetated banks, exposed tree roots, and exposed soil. Eroded banks indicate a problem of sediment movement and deposition, and suggest a scarcity of cover and organic input to streams. Each bank is evaluated separately and the cumulative score (right and left) is used for this parameter.
9. Bank Vegetative Protection (R, P)	Measures the amount of vegetative protection afforded to the stream bank and the near-stream portion of the riparian zone. The root systems of plants growing on stream banks help hold soil in place, thereby reducing the amount of erosion that is likely to occur. This parameter supplies information on the ability of the bank to resist erosion as well as some additional information on the uptake of nutrients by the plants, the control of instream scouring, and stream shading. Banks that have full, natural plant growth are better for fish and macroinvertebrates than are banks without vegetative protection or those shored up with concrete or riprap. This parameter is made more effective by defining the native vegetation for the region and stream type (i.e., shrubs, trees, etc.). In some regions, the introduction of exotics has virtually replaced all native vegetation. The value of exotic vegetation to the quality of the habitat structure and contribution to the stream ecosystem must be considered in this parameter. In areas of high grazing pressure from livestock or where residential and urban development activities disrupt the riparian zone, the growth of a natural plant community is impeded and can extend to the bank vegetative protection zone. Each bank is evaluated separately and the cumulative score (right and left) is used for this parameter.
10. Riparian Vegetated Zone Width (R, P)	Measures the width of natural vegetation from the edge of the stream bank out through the riparian zone. The vegetative zone serves as a buffer to pollutants entering a stream from runoff, controls erosion, and provides habitat and nutrient input into the stream. A relatively undisturbed riparian zone supports a robust stream system; narrow riparian zones occur when roads, parking lots, fields, lawns, bare soil, rocks, or buildings are near the stream bank. Residential developments, urban centers, golf courses, and rangeland are the common causes of anthropogenic degradation of the riparian zone. Conversely, the presence of "old field" (i.e., a previously developed field not currently in use), paths, and walkways in an otherwise undisturbed riparian zone may be judged to be inconsequential to altering the riparian zone and may be given relatively high scores. For variable size streams, the specified width of a desirable riparian zone may also be variable and may be best determined by some multiple of stream width (e.g., 4 x wetted stream width). Each bank is evaluated separately and the cumulative score (right and left) is used for this parameter.

[a] Modified from Barbour et al. (1999)

TABLE 14-2. PROCEDURE FOR CONDUCTING THE RAPID HABITAT ASSESSMENT

1. Based on observations during previous sample collection and field measurement activities, classify the sampling reach as predominantly flowing water habitat ("Riffle/run") or slow water habitat ("Pool/glide").

2. Select the appropriate version of the Rapid Habitat Assessment Form ("Riffle/Run Prevalence" or "Pool/Glide Prevalence") based on the classification in Step 1.

3. For each of the 10 habitat parameters, determine the general "quality" category ("POOR", "MARGINAL", "SUB-OPTIMAL", or "OPTIMAL") of the entire sampling reach. Assign and circle a score from the values available within each quality category. For Parameters 1 through 7, the sampling reach can be scored from 0 (worst) to 20 (best). For Parameters 8 through 10, each bank is evaluated separately (from 0 to 10), and the cumulative score for both right and left banks are used.

4. After the sampling reach has been scored for all parameters, transfer the score circled for each category to the corresponding "SCORE" box in the "HABITAT PARAMETER" column of the assessment form.

5. Sum the scores recorded in Step 4 over all 10 habitat parameters. Record the total score for the sampling reach in the "TOTAL SCORE" box on page 1 of the assessment form. The total score can range from 0 to 200.

Reviewed by (Initials): RC

RAPID HABITAT ASSESSMENT FORM: RIFFLE/RUN - STREAM

SITE ID: WXXP99-9999 DATE: 07/01/2000

HABITAT PARAMETER	CONDITION CATEGORY			
	OPTIMAL	SUB-OPTIMAL	MARGINAL	POOR
1. Epifaunal Substrate/ Available Cover	Greater than 70% of substrate favorable for epifaunal colonization and fish cover; mix of snags, submerged logs, undercut banks, cobble or other stable habitat and at stage to allow full colonization potential; (i.e., logs/snags that are NOT new fall and NOT transient.)	40-70% mix of stable habitat; well-suited for full colonization potential; adequate habitat for maintainance of populations; presence of additional substrate in the form of newfall, but not yet prepared for colonization (may rate at high end of scale).	20-40% mix of stable habitat; habitat availability less than desirable; substrate frequently disturbed or removed.	Less than 20% stable habitat; lack of habitat is obvious; substrate unstable or lacking.
Score: 12	20 19 18 17 16	15 14 13 (12) 11	10 9 8 7 6	5 4 3 2 1 0
2. Embeddedness	Gravel, cobble, and boulder particles are 0-25% surrounded by fine sediment. Layering of cobble provides diversity of niche space.	Gravel, cobble, and boulder particles are 25-50% surrounded by fine sediment.	Gravel, cobble, and boulder particles are 50-75% surrounded by fine sediment.	Gravel, cobble, and boulder particles are more than 75% surrounded by fine sediment.
Score: 8	20 19 18 17 16	15 14 13 12 11	10 9 (8) 7 6	5 4 3 2 1 0
3. Velocity/Depth Regime	All four velocity/depth regimes present (slow-deep, slow-shallow, fast-deep, fast-shallow). (Slow is less than 0.3 m/s, deep is greater than 0.5 m.)	Only 3 of the 4 regimes present (if fast-shallow is missing, score lower than if missing other regimes).	Only 2 of the 4 habitat regimes present (if fast-shallow or slow-shallow are missing, score low).	Dominated by 1 velocity/depth regime (usually slow-deep).
Score: 15	20 19 18 17 16	(15) 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
4. Sediment Deposition	Little or no enlargement of islands or point bars and less than 5% of the bottom affected by sediment deposition.	Some new increases in bar formation, mostly from gravel, sand or fine sediment; 5-30% of the bottom affected; slight deposition in pools.	Moderate deposition of new gravel, sand or fine sediment on old and new bars; 30-50% of the bottom affected; sediment deposits at obstructions, constrictions, and bends; moderate deposition of pools prevalent.	Heavy deposits of fine material; increased bar development; more than 50% of the bottom changing frequently; pools almost absent due to substantial sediment deposition.
Score: 14	20 19 18 17 16	15 (14) 13 12 11	10 9 8 7 6	5 4 3 2 1 0
5. Channel Flow Status	Water reaches base of both lower banks, and minimal amount of channel substrate is exposed.	Water fills over 75% of the available channel; or less than 25% of channel substrate is exposed.	Water fills 25-75% of the available channel, and/or riffle substrates are mostly exposed.	Very little water in channel and mostly present as standing pools.
Score: 12	20 19 18 17 16	15 14 13 (12) 11	10 9 8 7 6	5 4 3 2 1 0
6. Channel Alteration	Channelization or dredging absent or minimal; stream with normal pattern.	Some channelization present, usually in areas of bridge abutments; evidence of past channelization, i.e., dredging, (greater than past 20 yr) may be present, but recent channelization is not present.	Channelization may be extensive; embankments or shoring structures present on both banks; and 40 to 80% of stream reach channelized and disrupted.	Banks shored with gabion or cement; over 80% of the stream reach channelized and disrupted. Instream habitat greatly altered or removed entirely.
Score: 18	20 19 (18) 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0

03/31/2000 2000 Riffle Run

Draft

Figure 14-1. Rapid Habitat Assessment Form for riffle/run prevalent streams (page 1).

Reviewed by (Initials): RC

RAPID HABITAT ASSESSMENT FORM: RIFFLE/RUN (continued) - STREAM

SITE ID: WXXP99-9999 DATE: 07/01/2000

HABITAT PARAMETER	CONDITION CATEGORY			
	OPTIMAL	SUB-OPTIMAL	MARGINAL	POOR
7. Frequency of Riffles (or bends)	Occurrence of riffles relatively frequent; ratio of distance between riffles divided by width of the stream greater than 7:1 (generally 5 to 7); variety of habitat is key. In streams where riffles are continuous, placement of boulders or other large, natural obstruction is important.	Occurrence of riffles infrequent; distance between riffles divided by width of stream is between 7 to 15.	Occasional riffle or bend; bottom contours provide some habitat; distance between riffles divided by width of stream is between 15 to 25.	Generally all flat water or shallow riffles; poor habitat; distance between riffles divided by width of stream is a ratio of over 25.
Score: 13	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
8. Bank Stability (score each bank) NOTE: Determine left or right side by facing downstream.	Banks stable; evidence of erosion or bank failure absent or minimal; little potential for future problems. Less than 5% of bank affected.	Moderately stable; infrequent, small areas of erosion mostly healed over. 5-30% of bank in reach has areas of erosion.	Moderately unstable; 30-60% of bank in reach has areas of erosion; high erosion potential during floods.	Unstable; many eroded areas; "raw" areas frequent along straight sections and bends; obvious bank sloughing; 60-100% of bank has erosional scars.
Left Bank Score: 7	Left Bank: 10 9	8 7 6	5 4 3	2 1 0
Right Bank Score: 5	Right Bank: 10 9	8 7 6	5 4 3	2 1 0
9. Vegetative Protection (score each bank)	More than 90% of the streambank surfaces and immediate riparian zone covered by native vegetation, including trees, understory shrubs, or nonwoody macrophytes; vegetative disruption through grazing or mowing minimal or not evident; almost all plants allowed to grow naturally.	70-90% if the streambank surfaces covered by native vegetation; but one class of plants is not well represented; disruption evident but not affecting full plant growth potential to any great extent; more than one-half of the potential plant stubble height remaining.	50-70% of the streambank surfaces covered by vegetation; disruptions obvious; patches of bare soil or closely cropped vegetation common; less than one-half of the potential plant stubble height remaining.	Less than 50% of the streambank surfaces covered by vegetation; disruption of streambank vegetation is very high; vegetation has been removed to 5 centimeters or less in average stubble height.
Left Bank Score: 8	Left Bank: 10 9	8 7 6	5 4 3	2 1 0
Right Bank Score: 7	Right Bank: 10 9	8 7 6	5 4 3	2 1 0
10. Riparian Vegetative Zone Width (score each bank)	Width of riparian zone greater than 18 meters; human activities (i.e., parking lots, roadbeds, clear-cuts, lawns, or crops) have not impacted the zone.	Width of riparian zone 12-18 meters; human activities have impacted zone only minimally.	Width of riparian zone 6-12 meters; human activities have impacted zone a great deal.	Width of riparian zone less than 6 meters; little or no riparian vegetation due to human activities.
Left Bank Score: 6	Left Bank: 10 9	8 7 6	5 4 3	2 1 0
Right Bank Score: 5	Right Bank: 10 9	8 7 6	5 4 3	2 1 0

Figure 14-2. Rapid Habitat Assessment Form for riffle/run prevalent streams (page 2).

riffle/run version of the Rapid Habitat Assessment Form as shown in Figures 14-1 and 14-2. If the stream is classified as a pool/glide prevalent stream, record your scores for each parameter on the pool/glide version of the Rapid Habitat Assessment Form as shown in Figures 14-3 and 14-4. Transfer the scores assigned for each parameter to the box in the left-hand column of the form. Sum the scores for each parameter and record the total score in the box at the top of page 1 of the form.

14.2 VISUAL STREAM ASSESSMENT

The assessment form is designed as a template for recording pertinent field observations. It is by no means comprehensive and any additional observations should be recorded in the General Assessment section of the form. Complete the assessment form after all other sampling and measurement activities have been completed. Consider only things at or upstream of the X-site (things that may impact the sample reach). Take into account all observations the sampling team has made while at the site. The assessment includes the following components: watershed activities and observed disturbances, site characteristics, weather during sampling, and a general assessment. The procedure for conducting the visual assessment of the sampling reach is presented in Table 14-3. Record data and observations for each component of the assessment on the Assessment Form as shown in Figure 14-5.

Each watershed activity or disturbance is rated into one of four categories of abundance or influence: not observed, low, medium, or high. Leave the line blank for any activity or disturbance type not observed. The distinction between low, medium, and high will be subjective. For example, if there are 2-3 houses away from the stream, the rating for “Houses” may be low. If the stream is in a suburban housing development, rate it as high. Similarly, a small patch of clear cut logging on a hill overlooking the stream would be rated as low. Logging activity right on the stream shore, however, would be rated as high.

When assessing site characteristics, imagine a circle with a 200 m radius around the x-site (400 m diameter). Consider the land use and other activities within this circle. Water body character is defined as "the physical habitat integrity of the water body, largely a function of riparian and littoral habitat structure, volume change, trash, turbidity, slicks, scums, color, and odor.” Water body character is assessed using two attributes, the degree of human development, and aesthetics. Rate each of these attributes on a scale of 1 to 5. For development, give the stream a "5" rating if it is pristine, with no signs of any human development. A rating of "1" indicates a stream which is totally developed (e.g., the entire

Reviewed by (Initials): Rc

RAPID HABITAT ASSESSMENT FORM: GLIDE/POOL - STREAMS

SITE ID: WXXP99-9999 DATE: 07/01/2000

HABITAT PARAMETER	CATEGORY			
	OPTIMAL	SUB-OPTIMAL	MARGINAL	POOR
1. Epifaunal Substrate/ Available Cover	Greater than 50% of substrate favorable for epifaunal colonization and fish cover; mix of snags, submerged logs, undercut banks, cobble or other stable habitat and at stage to allow full colonization potential (i.e. logs/snags that are NOT new fall and NOT transient.)	30-50% mix of stable habitat; well-suited for full colonization potential; adequate habitat for maintenance of populations; presence of additional substrate in the form of newfall, but not yet prepared for colonization (may rate at high end of scale).	10-30% mix of stable habitat; habitat availability less than desirable; substrate frequently disturbed or removed.	Less than 10% stable habitat; lack of habitat is obvious; substrate unstable or lacking.
Score: 8	20 19 18 17 16	15 14 13 12 11	10 9 (8) 7 6	5 4 3 2 1 0
2. Pool Substrate Characterization	Mixture of substrate materials, with gravel and firm sand prevalent; root mats and submerged vegetation common.	Mixture of soft sand, mud, or clay; mud may be dominant; some root mats and submerged vegetation present.	All mud or clay or sand bottom; little or no root mat; no submerged vegetation.	Hard-pan clay or bedrock; no root mat or vegetation.
Score: 8	20 19 18 17 16	15 14 13 12 11	10 9 (8) 7 6	5 4 3 2 1 0
3. Pool Variability	Even mix of large-shallow, large-deep, small shallow, small-deep pools present.	Majority of pools large-deep; very few shallows.	Shallow pools much more prevalent than deep pools.	Majority of pools small-shallow or absent.
Score: 8	20 19 18 17 16	15 14 13 12 11	10 9 (8) 7 6	5 4 3 2 1 0
4. Sediment Deposition	Little or no enlargement of islands or point bars and less than 20% of the bottom affected by sediment deposition.	Some new increases in bar formation, mostly from gravel, sand or fine sediment; 20-50% of the bottom affected; slight deposition in pools.	Moderate deposition of new gravel, sand or fine sediment on old and new bars; 50-80% of the bottom affected; sediment deposits at obstructions, constrictions, and bends; moderate deposition of pools prevalent.	Heavy deposits of fine material; increased bar development; more than 80% of the bottom changing frequently; pools almost absent due to substantial sediment deposition.
Score: 7	20 19 18 17 16	15 14 13 12 11	10 9 8 (7) 6	5 4 3 2 1 0
5. Channel Flow Status	Water reaches base of both lower banks, and minimal amount of channel substrate is exposed.	Water fills over 75% of the available channel; or less than 25% of channel substrate is exposed.	Water fills 25-75% of the available channel, and/or riffle substrates are mostly exposed.	Very little water in channel and mostly present as standing pools.
Score: 18	20 19 (18) 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
6. Channel Alteration	Channelization or dredging absent or minimal; stream with normal pattern.	Some channelization present, usually in areas of bridge abutments; evidence of past channelization, i.e., dredging, (greater than past 20 yr) may be present, but recent channelization is not present.	Channelization may be extensive; embankments or shoring structures present on both banks; and 40 to 80% of stream reach channelized and disrupted.	Banks shored with gabion or cement; over 80% of the stream reach channelized and disrupted. Instream habitat greatly altered or removed entirely.
Score: 16	20 19 18 17 (16)	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0

Draft

03/31/2000 Glide Pool

Figure 14-3. Rapid Habitat Assessment Form for pool/glide prevalent streams (page 1).

Reviewed by (Initials): RC

RAPID HABITAT ASSESSMENT FORM: GLIDE/POOL (continued) - STREAMS

SITE ID: WXXP99-9999 DATE: 07/01/2000

HABITAT PARAMETER	CATEGORY			
	OPTIMAL	SUB-OPTIMAL	MARGINAL	POOR
7. Channel Sinuosity Score: 13	The bends in the stream increase the stream length 3 to 4 times longer than if it was in a straight line. (Note- channel braiding is considered normal in coastal plains and other low-lying areas. This parameter is not easily rated in these areas.) 20 19 18 17 16	The bends in the stream increase the stream length 2 to 3 times longer than if it was in a straight line. 15 14 (13) 12 11	The bends in the stream increase the stream length 1 to 2 times longer than if it was in a straight line. 10 9 8 7 6	Channel straight; waterway has been channelized for a long distance. 5 4 3 2 1 0
8. Bank Stability (score each bank) NOTE: Determine left or right side by facing downstream. Left Bank Score: 9	Banks stable; evidence of erosion or bank failure absent or minimal; little potential for future problems. Less than 5% of bank affected. Left Bank: 10 (9)	Moderately stable; infrequent, small areas of erosion mostly healed over. 5-30% of bank in reach has areas of erosion. 8 7 6	Moderately unstable; 30-60% of bank in reach has areas of erosion; high erosion potential during floods. 5 4 3	Unstable; many eroded areas; "raw" areas frequent along straight sections and bends; obvious bank sloughing; 60-100% of bank has erosional scars. 2 1 0
Right Bank Score: 10	Right Bank: (10) 9	8 7 6	5 4 3	2 1 0
9. Vegetative Protection (score each bank) Left Bank Score: 4	More than 90% of the streambank surfaces and immediate riparian zone covered by native vegetation, including trees, understory shrubs, or nonwoody macrophytes; vegetative disruption through grazing or mowing minimal or not evident; almost all plants allowed to grow naturally. Left Bank: 10 9	70-90% if the streambank surfaces covered by native vegetation; but one class of plants is not well represented; disruption evident but not affecting full plant growth potential to any great extent; more than one-half of the potential plant stubble height remaining. 8 7 6	50-70% of the streambank surfaces covered by vegetation; disruptions obvious; patches of bare soil or closely cropped vegetation common; less than one-half of the potential plant stubble height remaining. 5 (4) 3	Less than 50% of the streambank surfaces covered by vegetation; disruption of streambank vegetation is very high; vegetation has been removed to 5 centimeters or less in average stubble height. 2 1 0
Right Bank Score: 6	Right Bank: 10 9	8 7 (6)	5 4 3	2 1 0
10. Riparian Vegetation Zone Width (score each bank) Left Bank Score: 5	Width of riparian zone greater than 18 meters; human activities (i.e., parking lots, roadbeds, clear-cuts, lawns, or crops) have not impacted the zone. Left Bank: 10 9	Width of riparian zone 12-18 meters; human activities have impacted zone only minimally. 8 7 6	Width of riparian zone 6-12 meters; human activities have impacted zone a great deal. (5) 4 3	Width of riparian zone less than 6 meters; little or no riparian vegetation due to human activities. 2 1 0
Right Bank Score: 7	Right Bank: 10 9	8 (7) 6	5 4 3	2 1 0

03/31/2000 Glide Pool

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Figure 14-4. Rapid Habitat Assessment Form for glide/pool prevalent streams (page 2).

TABLE 14-3. PROCEDURE FOR CONDUCTING THE FINAL VISUAL ASSESSMENT OF A STREAM

1. After all other sampling and measurement activities are completed, fill out the header section of an Assessment Form. Use your perceptions obtained during the course of the day, while at the stream or driving/walking through the catchment to complete the remainder of the form. Consider only things at or upstream of the x-site.

2. WATERSHED ACTIVITIES AND DISTURBANCES OBSERVED: Rate each type of activity or disturbance listed on the form as either "Not observed", "Low", "Medium", or "High", and record the rating on the Assessment Form. Keep in mind that ratings will be somewhat subjective and that an extensive effort to quantify the presence and intensity of each type of stressor is not required. General categories of activities and types of disturbance are described below:

   - Residential: The presence of any of the listed disturbances adjacent to or near the stream.
   - Recreational: The presence of organized public or private parks, campgrounds, beaches or other recreation areas around the stream. If there are signs of informal areas of camping, swimming or boating around the stream (e.g., swimming hole), record them as "primitive" parks, camping.
   - Agriculture: The presence of cropland, pasture, range, orchards, poultry, and/or livestock. Also note any evidence of water withdrawals for agriculture.
   - Industrial: Any industrial activity (e.g., canning, chemical, pulp), commercial activity (stores, businesses) or logging/mining activities around the stream or in the catchment. Describe in more detail in the comments section.
   - Management: Any evidence of water treatment, dredging or channelization, flow control structures, fish stocking, dams or other management activities.

   Any oddities, or further elaboration should be recorded in the Comments section.

3. SITE CHARACTERISTICS: (based on a circle with a 200 m radius around the x-site)

   - WATER BODY CHARACTER: Assign a rating of 1 (highly disturbed) to 5 (pristine) based on your general impression of the intensity of impact from human disturbance. Place an "X" in the box next to the assigned rating on the Assessment Form. Assign a rating to the stream based on overall aesthetic quality, based on your opinion of how suitable the stream water is for recreation and aesthetic enjoyment today. Place and "X" in the box next to the assigned rating on the Assessment Form.

     5. Beautiful, could not be any nicer.
     4. Very minor aesthetic problems; excellent for swimming, boating, enjoyment.
     3. Enjoyment impaired.
     2. Level of enjoyment substantially reduced.
     1. Enjoyment nearly impossible.

(continued)

TABLE 14-3 (Continued)

- Beaver: If you noticed any signs of beaver presence in the stream (chewed sticks, trees, dams, lodges) rate the beaver presence as either rare or common. If no beaver signs were present, mark the absent box. Also rate the amount of flow modification caused by any **beaver activity** as none, minor, or major.

- Dominant Land Use: Make one estimate of the dominant land use in the circle around the x-site. Pick just one land use from among Forest, Agriculture, Range, Urban, Suburban/Town. If there are other major land uses, make note of them in the General Assessment section of the form. If forest is the dominant land use, make a guess as to the dominant age class of the forest (0-25, 25-75, or > 75 years).

3. WEATHER: record a very brief description of the weather conditions during stream sampling (e.g., sunny, fair, partly cloudy, overcast, light rain, unseasonably warm, cold, or hot, etc.). Any unusual weather right before sampling (e.g., heavy rain, 6 inches of snow) is also worth noting here.

4. GENERAL ASSESSMENT: record comments on wildlife observed, perceived diversity of terrestrial/riparian vegetation, or overall biotic integrity on the Assessment Form. Record any information regarding the past or present characteristics or condition of the stream provided by local residents here as well.

STREAM ASSESSMENT FORM - STREAMS/RIVERS

Reviewed by (initial): JP

SITE ID: WXXP99-9999 DATE: 07/01/2001

WATERSHED ACTIVITIES AND DISTURBANCES OBSERVED (Intensity: Blank=Not observed, L=Low, M=Moderate, H=Heavy)

Residential	Recreational	Agricultural	Industrial	Stream Management
(L) M H Residences	L M H Hiking Trails	L M H Cropland	L M H Industrial Plants	L M H Liming
(L) M H Maintained Lawns	L M H Parks, Campgrounds	L M (H) Pasture	L M H Mines/Quarries	L M H Chemical Treatment
L M H Construction	L M H Primitive Parks, Camping	L (M) H Livestock Use	L M H Oil/Gas Wells	L M H Angling Pressure
L M H Pipes, Drains	L M H Trash/Litter	L M H Orchards	L M H Power Plants	L M H Dredging
L M H Dumping	L M H Surface Films	L M H Poultry	L M H Logging	L M H Channelization
(L) M H Roads		L M H Irrigation Equip.	L M H Evidence of Fire	L M H Water Level Fluctuations
L M H Bridge/Culverts		L M H Water Withdrawal	L M H Odors	L M H Fish Stocking
L M H Sewage Treatment			L M H Commercial	L M H Dams

SITE CHARACTERISTICS (200 m radius)

Waterbody Character	Pristine	☐ 5	☐ 4	☐ 3	☒ 2	☐ 1	Highly Disturbed
	Appealing	☐ 5	☐ 4	☒ 3	☐ 2	☐ 1	Unappealing
Beaver	Beaver Signs:	☒ Absent	☐ Rare	☐ Common			
	Beaver Flow Modifications:	☒ None	☐ Minor	☐ Major			
Dominant Land Use	Dominant Land Use Around 'X'	☐ Forest	☐ Agriculture	☒ Range	☐ Urban	☐ Suburban/Town	
	If Forest, Dominant Age Class	☐ 0 - 25 yrs.	☐ 25 - 75 yrs.	☐ > 75 yrs.			

WEATHER CLEAR, WITH LIGHT RAIN IN THE PREVIOUS 24 HOURS. AIR TEMP 28° AT 11 AM.

GENERAL ASSESSMENT (Biotic integrity, Vegetation diversity, Local anecdotal information)

RIPARIAN TREES AGE CLASS: 25-75 YR. THOUGH TREE DENSITY IS LOW. LOCAL CONTACT REMEMBERS A DAM LOCATED JUST DOWNSTREAM OF X-SITE THAT WAS WASHED AWAY 10 YR AGO DURING A LARGE FLOOD EVENT. NO SIGNS OF BIRDS OR WILDLIFE OBSERVED DURING VISIT.

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03/26/2001 2001 Stream Assessment

Figure 14-5. Stream Assessment Form (page 1).

stream is lined with houses, or the riparian zone has been removed). For aesthetics, base your decision on any factor about the stream that bothers you (e.g., trash, algal growth, weed abundance, overcrowding). Also, rate the presence/absence of beaver and the dominant land use within this circle according to the classes listed on the form

The weather and general assessment component includes any observations that will help in data interpretation in the pertinent section. The weather component is just a place to record a brief description of the weather during sampling or just before sampling. General assessment comments can include comments on wildlife observed, diversity of terrestrial/riparian vegetation, overall biotic integrity, or any other observation. Comments from locals about current or past conditions are often useful and should be recorded in this section as well. The back side of the form (Figure 14-6) is available for additional general comments.

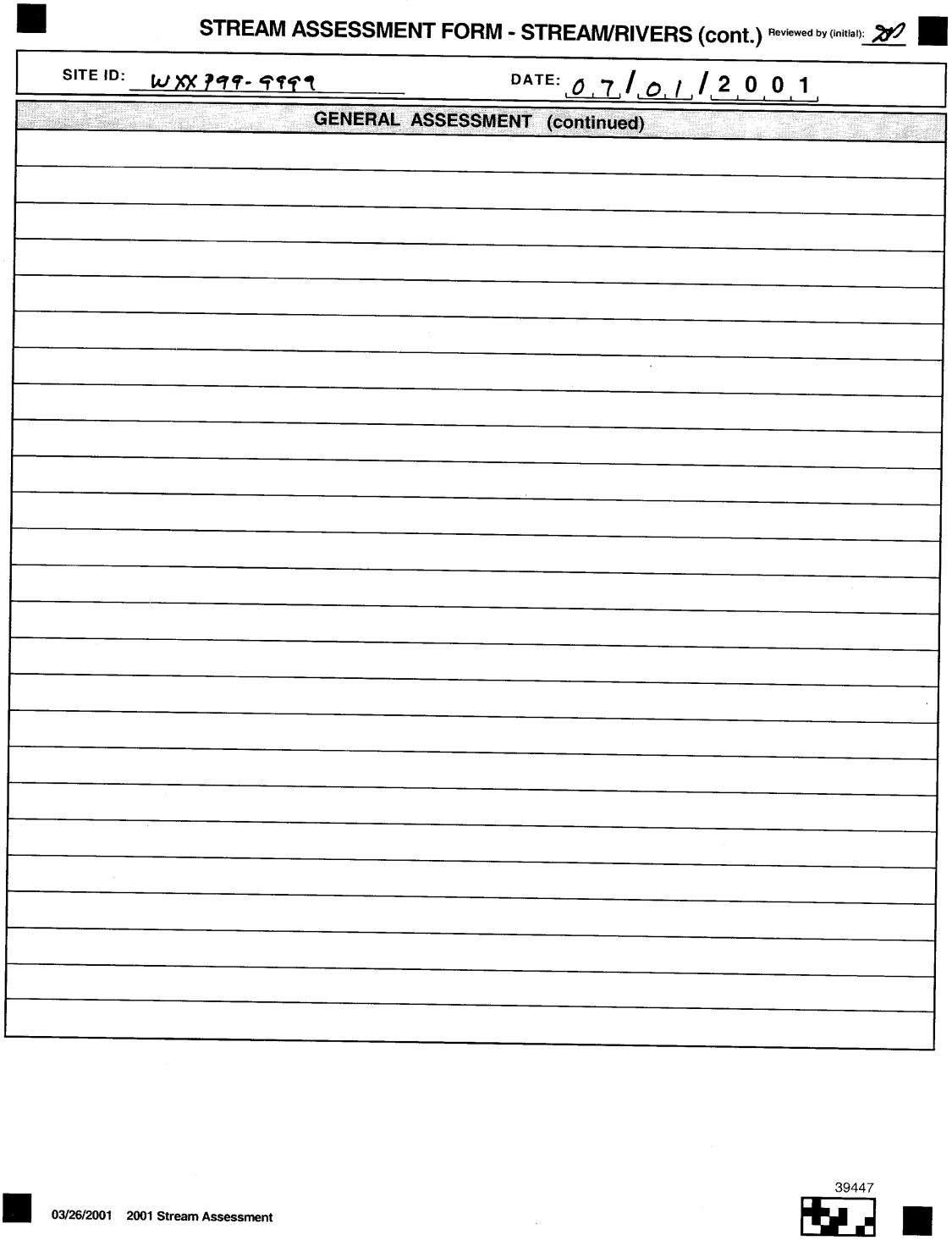
14.3 EQUIPMENT AND SUPPLIES

Figure 14-7 is a checklist of the supplies required to complete the visual stream assessment. This checklist may differ from the checklists presented in Appendix A, which are used at a base site to ensure that all equipment and supplies are brought to and are available at the stream site. Field teams are required to use the checklist presented in this section to ensure that equipment and supplies are organized and available to conduct the protocols efficiently.

14.3 LITERATURE CITED

Barbour, M.T., J. Gerritsen, B.D. Snyder, and J.B. Stribling. 1999. *Rapid Bioassessment Protocols for Use in Streams and Wadeable Rivers: Periphyton, Benthic Macroinvertebrates, and Fish*. Second Edition. EPA/841-B-99-002. U.S. Environmental Protection Agency, Office of Water, Assessment and Watershed Protection Division, Washington, D.C.

Gordon, N.D., T.A. McMahon, and B.L. Finlayson. 1992. *Stream hydrology: an introduction for ecologists.* John Wiley and Sons, Inc., West Sussex, England.



STREAM ASSESSMENT FORM - STREAM/RIVERS (cont.) Reviewed by (initial): JD

SITE ID: WXX999-9999 DATE: 07/01/2001

GENERAL ASSESSMENT (continued)

03/26/2001 2001 Stream Assessment

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Figure 14-6. Stream Assessment Form (page 2).

EQUIPMENT AND SUPPLIES FOR RAPID HABITAT AND VISUAL STREAM ASSESSMENTS

QTY.	Item	
1	Rapid Habitat Assessment Form for Riffle/run prevalent streams	
1	Rapid Habitat Assessment Form for Pool/glide prevalent streams	
1	Assessment Form for visual stream assessment	
6	Soft (#2) lead pencils	
1	Covered clipboard or forms holder	
1 copy	Field operations and methods manual	
1 set	Laminated sheets of procedure tables and/or quick reference guides for rapid habitat and visual assessments	

Figure 14-7. Checklist of equipment and supplies required for rapid habitat and visual stream assessments.

Lazorchak, J.M., A.T. Herlihy, and J. Green. 1998. Rapid Habitat and Visual Stream Assessments. pp. 193-209 IN: J.M. Lazorchak, D.J. Klemm, and D.V. Peck (Eds.). *Environmental Monitoring and Assessment Program-Surface Waters: Field Operations and Methods for Measuring the Ecological Condition of Wadeable Streams*. EPA/620/R-94/004F. U.S. Environmental Protection Agency, Washington, D.C.

Plafkin, J.L., M.T. Barbour, K.D. Porter, S.K. Gross, and R.M. Hughes. 1989. *Rapid Bioassessment Protocols for Use in Streams and Rivers: Benthic Macroinvertebrates and Fish.* EPA/440/4-89/001. U.S. Environmental Protection Agency, Assessment and Watershed Protection Division, Washington, D.C.

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